

IMPLEMENTATION OF A SOLAR THERMAL HEATING SYSTEM: ENERGY AND ECONOMIC ANALYSIS

Juan Pablo Vargas Bautista, Pablo Yampasi Espejo, Xerxes Tirado Villarroel y Andrés Patzi

ABSTRACT

This work presents the implementation of a solar heating system that uses thermal vacuum tubes to heat a thermal fluid: Solar energy is used as a primary energy source. The stored energy is used to heat a room with an area of 45.5 square meters. The system was developed in order to determine both technical and economic feasibility and for its implementation in cold regions in Bolivia. The system features a solar collector vacuum tube which is connected by pipes to a heat exchanger. A pump is used for circulating the hot fluid to the heat exchanger, a fan is used to heat the cold air in the room and to accelerate the heat transfer process in the heat exchanger. The solar heating system has a thermostat to control the temperature in the room, to optimize the available solar energy and to reduce the electric consumption of the water pump and air fan. The solar heating system was able to reach the desire temperature in the room in 3 hours, the rest of the time the thermal collector stored the remaining solar energy in the water tank that will be used the next day. An electric heating system of 4 kW was used to heat the same room under the same conditions as the solar heating system. As a benefit, a monthly electricity savings of 163.1 kWh was achieved with the solar heating system that represents an estimated cost savings of 23.4 \$US of electricity. By reducing power consumption, gas emissions greenhouse was also reduced in 81.5 kg CO₂. For this specific case of study and considering the solar heating system is working all year, a payback time of 5.3 years can be obtained. As an important parameter, one square meter of solar thermal evacuated tubes can heat a room of 16.5 m².

Keywords: Solar Heating Systems, Solar Thermal Energy, Renewable Energies.